Coiled Brine Recovery Assembly (CoBRA) Project

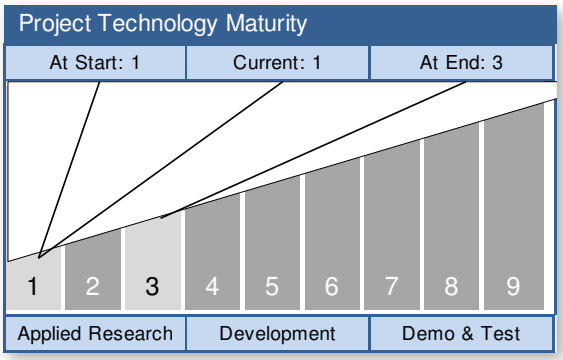
Center Innovation Fund: JSC CIF (Also Includes JSC IRAD) Program

Space Technology Mission Directorate (STMD)

National Aeronautics and Space Administration

ABSTRACT

The Coiled Brine Recovery Assembly (CoBRA) project will result in a proof-of-concept demonstration for a lightweight, compact, affordable, regenerable and disposable solution to brine water recovery. The heart of CoBRA is an evaporator that produces water vapor from brine. This evaporator leverages a novel design that enables passive transport of brine from place to place within the system. While it will be necessary to build or modify a system for testing the CoBRA concept, the emphasis of this project will be on developing the evaporator itself. This project will utilize a ...***Read more on the last page.***



Technology Area: Human Health, Life Support & Habitation Systems
TA06 (Primary)

ANTICIPATED BENEFITS

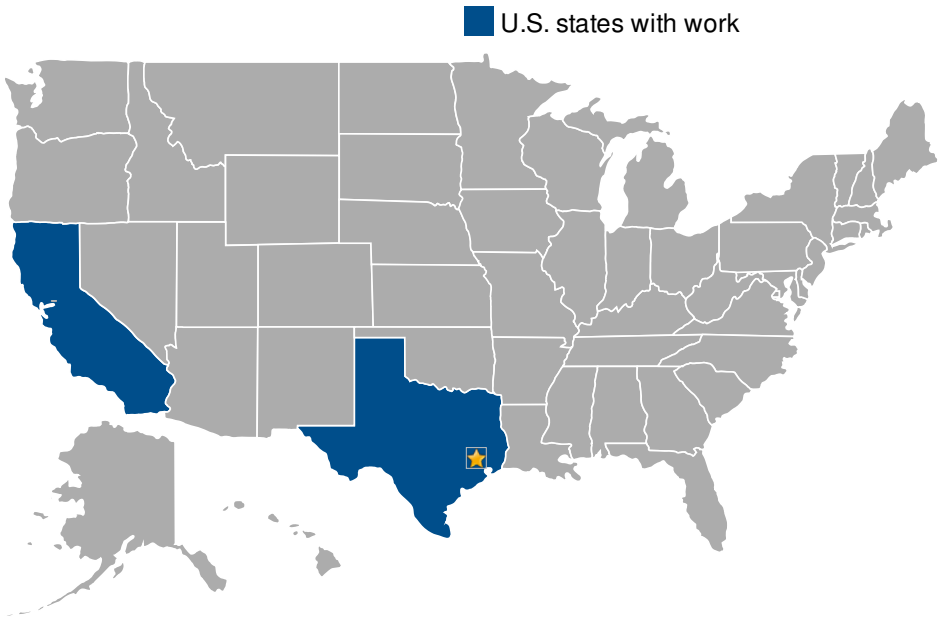
To NASA funded missions:

After CoBRA undergoes necessary further development, the technology could be integrated into the International Space Station (ISS) life support system as a brine processor. This has the potential to recover 575 pounds of water per year from brine. This represents roughly $10M per year in savings on water resupply costs.

To NASA unfunded & planned missions:

While the primary function of the CoBRA is to recover water from concentrated ...

Read more on the last page.



DETAILED DESCRIPTION

The Coiled Brine Recovery Assembly (CoBRA) project will result in a proof-of-concept demonstration for a lightweight, compact, affordable, regenerable and disposable solution to brine water recovery. The heart of CoBRA is an evaporator that produces water vapor from brine. This evaporator leverages a novel design that enables passive transport of brine from place to place within the system. While it will be necessary to build or modify a system for testing the CoBRA concept, the emphasis of this project will be on developing the evaporator itself. This project will utilize a “test early, test often” approach, building at least one trial evaporator to guide the design of the final product.

MANAGEMENT

Program Executive:
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Program Manager:
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Project Manager:
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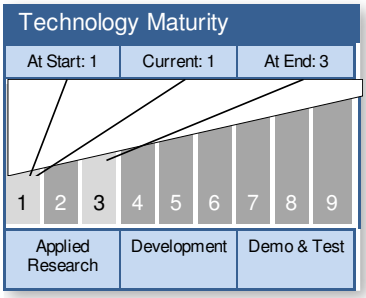
Principal Investigator:
Stuart Pensinger

TECHNOLOGY DETAILS

Coiled Brine Recovery Assembly (CoBRA)



TECHNOLOGY DESCRIPTION

Brine water recovery is the final link in achieving closure of the water loop. It's a game-changer; if mastered, a technology gap is closed in providing a water supply for manned deep-space exploration missions. It is a challenging problem, however. When wastewater brines are dried, the residual is inevitably a viscous goo, laden with particles of precipitated solids. This brine residual causes problems for traditional recovery systems: clogging pitot tubes, causing bearings to seize, fouling heat transfer surfaces. The key feature of CoBRA that makes it a reliable life support technology is its passive technique for transporting brine and brine residual in microgravity. This technique prevents sensitive components, such as those aforementioned in traditional systems, from coming into contact with brine and brine residual. Instead of fighting brine residual, the CoBRA system embraces it.

This technology is categorized as a hardware subsystem for manned spaceflight

- Technology Area
    - TA06 Human Health, Life Support & Habitation Systems (Primary)

CAPABILITIES PROVIDED

Water recovery via brine processing is an absolute necessity for closure of the water loop. The fundamental problem faced by all water recovery systems when exceeding ~85% recovery is the precipitation of solids. In order for a brine processor to be reliable, it must be tolerant of the solids that are inherently generated during the process. This means minimizing the number of moving parts that come in contact with brine solids, and avoiding manipulation of brine residuals as a critical link in the process. Historical data suggests that total water recovery rates exceeding 98% should be attainable by this system, representing a significant step towards water loop closure.

This technology is primarily meant to recover water from concentrated wastewater brines. The current state-of-the-art water recovery level is 85%. Brine water recovery enables recovery levels in excess of this mark, with the potential to reach nearly 100% recovery of available water. While CoBRA technology is tailored to address the challenges of handling hazardous liquids in a microgravity spacecraft environment, it could be used to solve terrestrial problems as well. Potential applications on Earth include recovery of water from highly contaminated ...

TECHNOLOGY DETAILS

POTENTIAL APPLICATIONS (CONT'D)

wastewater, including wastes generated by the petroleum, chemical, power generation, and biopharmaceutical industries. Specific examples include treatment of nuclear cooling water and hydraulic fracturing (fracking) water.

ABSTRACT (CONTINUED FROM PAGE 1)

"test early, test often" approach, building at least one trial evaporator to guide the design of the final product.

ANTICIPATED BENEFITS

To NASA unfunded & planned missions: (CONT'D)

wastewater brines generated by a primary processor, the CoBRA may be able to function as a primary processor itself. Current state-of-the-art primary processors rely on rotating drums, pitot pumps, lobe compressors, and other sensitive machinery for operation. This equipment has a history of becoming fouled due to solids precipitation. In the case of a failure of the primary processor, the CoBRA could serve as a backup, providing dissimilar redundancy to ensure crew survival.

Upon successful demonstration of a proof-of-concept evaporator, Advanced Exploration Systems (AES) will provide funding for further development. This will lead to infusion of CoBRA technology into an integrated closed-loop life support system architecture. The CoBRA will then be poised to play a key role in a future ground-based integrated life support systems test, and an eventual ISS detailed test objective (DTO). After a successful DTO, CoBRA could be integrated into the International Space Station (ISS) life support system, with the potential to recover 575 pounds of water per year from brine. This represents roughly $10M per year in savings on water resupply costs. Leveraging the extensive technology maturation and testing accomplished through a DTO, the CoBRA will then be ready for use by future deep-space exploration programs.

To the nation:

CoBRA technology also has the potential to be used for water recovery from contaminated wastes in the chemical, nuclear, and hydraulic fracturing industries.